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(54) Bin hoist and method of lifting and tipping a bin.

(57) A bin hoist comprising a bin carrier (100), holding means (102, 104) on the bin carrier for holding a bin (50) on the carrier, a support (154) for the bin carrier and tipping means (166) for tipping the bin carrier relative to the support, wherein the tipping means includes an hydraulic motor and means (416) for restricting the flow of hydraulic fluid to or from the motor as the bin carrier approaches an end of its travel in a tipped attitude.

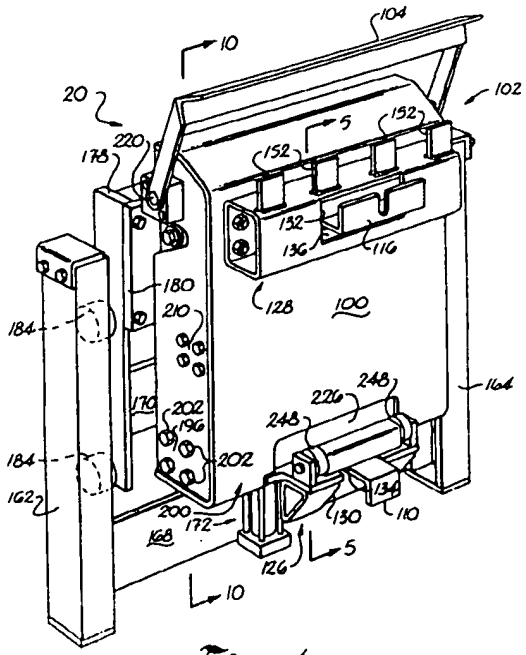

Fig. 4

EP 0 575 867 A2

Description of Invention

The present invention relates to a bin hoist suitable for lifting and tipping a bin to discharge contents of the bin. The invention also relates to a method of lifting and tipping a bin.

Bin hoists are used on collection vehicles, for example, vehicles used for collecting refuse, and on containers which are intended to receive material from a number of bins.

According to a first aspect of the invention, there is provided a bin hoist comprising a bin carrier, holding means on the bin carrier for holding a bin on the carrier, a support for the bin carrier and tipping means for tipping the bin carrier relative to the support, wherein the tipping means includes an hydraulic motor and means for restricting the flow of hydraulic fluid to or from the motor as the bin carrier approaches an end of its travel in a tipped attitude.

According to a further aspect of the invention, there is provided a method of lifting and tipping a bin to discharge contents from the bin wherein the bin is raised from the ground, is tipped at an approximately uniform rate until a top of the bin is lower than a bottom of the bin and wherein the rate of tipping is then reduced before the bin reaches the limit of its travel.

Examples of bin hoists in accordance with the invention and which are used in the carrying out of methods embodying the invention will now be described, with reference to the accompanying drawings, wherein:

FIGURE 1 shows a perspective view of a refuse collection vehicle having a bin hoist at a rear of a body of the vehicle, together with a bin,

FIGURE 2A is a partial side view of an example of refuse collection vehicle having a front load box arrangement,

FIGURE 2B shows, on a larger scale, a kick plate and associated parts incorporated in the vehicle of Figure 2A,

FIGURE 3 shows a part of the vehicle and a box arrangement of Figure 2A, together with a bin which has been inverted for emptying contents of the bin into the box,

FIGURE 4 is a perspective view of the hoist of the vehicle of Figure 1,

FIGURE 5 shows a partial cross-section of the hoist on the line 5-5 of Figure 4,

FIGURE 6A shows a perspective view of a bin which can be lifted and tipped by the hoist of Figure 4,

FIGURE 6B is a diagrammatic representation of parts of the hoist and of the bin, illustrating co-operation of the hoist of Figure 4 with the bin of Figure 6A,

FIGURE 7A shows a perspective view of a further example of bin which can be lifted and tipped by the hoist of Figure 4,

FIGURE 7B is a diagrammatic representation of parts of the hoist and of the bin of Figure 7A, illustrating co-operation between the hoist and the bin of Figure 7A,

FIGURES 8A - 8D are diagrammatic representations of successive stages in operation of the hoist of Figure 4 for lifting and tipping the bin of Figure 6A,

FIGURES 9A - 9D are diagrammatic representations illustrating operation of the hoist of Figure 4 to lift and tip the bin of Figure 7A,

FIGURE 10 shows a cross-section of the hoist on the line 10-10 of Figure 4,

FIGURE 11 is a view of the hoist of Figure 4 from the rear,

FIGURES 12A - 12E are diagrammatic representations of stages in operation of the hoist of Figure 4 to lift and tip a bin,

FIGURE 13 shows a partial cross-section of the hoist to illustrate tipping means of the hoist,

FIGURE 14 is a different partial cross-section of the hoist illustrating adjustment means of the hoist,

FIGURE 15 is a perspective view of certain parts of the hoist of Figure 4 illustrating features of an extendable bin rest of the hoist,

FIGURES 16A and 16B are perspective views (showing opposite sides) of sequencing means which may be incorporated in the hoist of Figure 4,

FIGURES 17 and 18 show different cartridges which may be incorporated in the sequencing means of Figure 16A

FIGURE 19 shows diagrammatically an hydraulic circuit of the hoist of Figure 4,

FIGURE 20 is a perspective view of certain parts only of a further example of hoist, illustrating a modification of the hoist of Figure 4,

FIGURE 21 shows a partial cross-section on the line 21-21 of Figure 20,

FIGURE 22 shows a partial cross-section on the line 22-22 of Figure 20,

FIGURE 23 shows on an enlarged scale certain of the parts shown in Figure 22,

FIGURE 24 shows in cross-section certain parts of tipping means of the hoist of Figure 4,

FIGURE 25 shows on a further enlarged scale certain parts shown in Figure 24, and

FIGURE 26 is a view corresponding to Figure 25 but representing a movable component of the tipping means in a different position.

Figure 1 shows a refuse collection vehicle 22 having a bin hoist 20 mounted on horizontal rave rail 24 at the rear of a body of the vehicle. Adjacent to the rear of the body, there is a hopper and the

hoist can be used for lifting a bin 26 and discharging contents of the bin into the hopper. The particular bin represented in Figure 1 has a pair of vertically spaced, horizontal bars 30 and 32 with which the hoist can co-operate.

The hoist, which is shown more clearly in Figure 4, comprises a bin carrier 100 provided with alternative sets of holding means for holding bins of respective different kinds on the bin carrier. A first of the holding means comprises a lower clamp member 102 and an upper clamp member 104 between which there can be received the lip 52 of the bin 50 represented in Figure 3. The lower clamp 102 is fixed on the bin carrier 100 and the upper member 104 is connected with the bin carrier for pivoting relative thereto towards and away from the lower member 102 about a generally horizontal axis. Reference no. 106 identifies actuation means for moving the upper clamp member 104. This actuation means includes at least one linkage 108 linking the upper clamp member 104 with further components of the hoist which move during operation of the hoist.

The second of the holding means includes a lower member 110 mounted for pivotal movement relative to the bin carrier 100 between an extended position, which is represented by full lines in Figures 4 and 5, and a retracted position represented by a broken line in Figure 5. A spring is provided for urging the member 110 to the extended position and the member can be pushed to the retracted position by the bin 50 if that bin approaches the bin carrier 100.

The second holding means further comprises an upper member 116 which is also mounted for pivoting relative to the bin carrier 100 between an extended position represented by full lines in Figures 4 and 5 and a retracted position represented by a broken line. A spring is provided for urging the upper member 116 towards its extended position and this member can be pushed to its retracted position by the bin 50, if that bin approaches the bin carrier 100.

The second holding means 110, 116 is used for holding the bin 26 on the bin carrier 100, the holding means engaging the bars 30 and 32 of the bin, as represented in Figure 6B.

The bin 50 is shown in Figure 7A and the way in which the first holding means 102, 104 cooperates with the lip 52 of this bin is represented in Figure 7B.

The hoist further comprises a support 154 for the bin carrier 100. The support is guided by upright guides 162 and 164 for upward and downward movement relative to the body of the vehicle 22 and lifting means comprising an hydraulic cylinder 172 is provided for raising the support 154 and the bin carrier 100 relative to the guides 162 and 164. The support i[redacted] may include a support frame 178 which comprises a pair of generally vertical support elements 180 and 182 with rollers 184 carried on the support elements to run in the vertical guides 162 and 164.

For tipping the bin carrier 100 relative to the support 154, there is provided tipping means 166 which includes an hydraulically actuated rotary motor having a transverse output shaft 186 with respective ends 188 and 190. A pair of torque arms 192 and 194 are received on and fixed with respect to the end portions of the output shaft. The opposite ends of the torque arms are pivotally connected with the bin carrier 100 at points 196 and 198 adjacent to a base 200 of the bin carrier. Bolts 202 provide respective bearings 204 for each of the torque arms.

A pair of idler arms 206 and 208 is pivotally connected adjacent to respective first ends thereof on the support frame 178 and adjacent to second ends thereof on the bin carrier 100. The respective pivot axes 210 and 212 about which the idler arms pivot relative to the support 154 and the bin carrier 100 are spaced considerably from the base portion 200 of the bin carrier and are offset from the attachment points 196 and 198 of the torque arms 192 and 194.

The linkage 108 acts between the upper clamp member 104 and one of the arms 192, 194, 206 and 208. The length of the linkage 108 may be adjustable to vary the action of the upper clamp 104.

Figure 11 shows in more detail an example of a suitable linkage, connecting arms 216 and 218 to torque arms 192 and 194 respectively. It will be understood that alternatively the linkage may be connected with the idler arms 206 and 208.

The hoist further comprises a bin rest 226 mounted for reciprocation relative to the bin carrier 100 between an extended position and a retracted position relative to a lower margin of the bin carrier. On the bin rest, there is a roller 248 for bearing against the bin 50 when the bin is lifted from the ground by the holding means 102, 104. A pair of links 228 and 230 are connected between the bin rest 226 and the support 154, for example a frame 178 of the support. The links 228 and 230 are free to pivot relative to the bin rest and the support.

Channels 223 and 234 are provided on the bin carrier 100 at the face thereof which faces forwards with respect to the vehicle, when the bin carrier is in the lowered position. The bin rest 226 includes a plate having opposite marginal portions which are received in the slide channels 232 and 234.

The lower member 110 of the second holding means is carried on the bin rest 226 for reciprocation therewith relative to the bin carrier 100.

Tipping means 166 for tipping the bin carrier 100 relative to the support 154 is shown in Figure 13. Suitable tipping means is disclosed in US-4,773,812, the contents of which are incorporated herein by reference. The tipping means comprises an hydraulic piston and cylinder unit with a rack incorporated in or mounted on a piston rod of this unit and a pinion mounted on the output shaft 186 of the tipping means. Respective teeth of the rack and pinion are mutually enmeshed inside the cylinder of the piston and cylinder unit, where they are lubricated by the hydraulic fluid supplied to the cylinder.

The piston and cylinder unit of the tipping means 166 are incorporated in the hydraulic circuit represented in Figure 19 and certain other components of this circuit are represented in Figures 16 - 18. Hose interconnections designated in the same way in these Figures, for example as "A" correspond. Figure 17 shows a check valve cartridge 270 which is outfitted with an O-ring seal 274 and a further O-ring seal 276 which is adjacent to a pair of back-up washers 278 and 280. The check valve cartridge 270 is incorporated in the dual sequence valve 268. Element 282 associated with this valve is a plug for sealing ports of the valve not used in the circuit of Figure 19.

Element 272 is a further sequence valve cartridge which also includes O-ring seals and which is incorporated in the dual sequence valve 268. In Figure 19, the components within the broken line 300 constitute the dual sequence valve 268. The components within the broken line 302 constitute a diverter valve.

The diverter valve is arranged for receiving hydraulic fluid through a main pressure line 304 from an hydraulic pump or similar source. When appropriately set, the diverter valve can cause the pressurised fluid to be directed to compaction means of the vehicle 222 via hydraulic line 306. The diverter valve 302 can also direct hydraulic fluid along line 308 to operate the hoist 20. The reference numeral 310 identifies a hand-operated valve for initiating operation of the hoist.

In Figure 19, the reference numeral 320 identifies a piston and cylinder unit corresponding to the lift cylinder 172.

When the valve 310 is actuated to direct hydraulic fluid through port VA into the dual sequencing valve 268, that fluid is initially directed through port C1A to the piston and cylinder unit 320 to extend that unit and thereby raise the support 154 relative to the guides 162 and 164. When the pressure at the port C1A exceeds a predetermined threshold value, for example 1,000 psi, the sequence valve cartridge 270 shifts so as to direct the hydraulic fluid flow through port C2A. The return of hydraulic fluid from tipping means 322 is via port VB to the hydraulic reservoir.

The piston and cylinder unit of the tipping means 166 comprises means for restricting flow of hydraulic fluid into or from the cylinder of the unit. This means comprises a member guided for reciprocation relative to the cylinder of the unit along a path which is parallel to the path of reciprocation of the piston of the unit. During operation of the device, the member is engaged by the piston and moved by the piston but through only a part of the stroke of the piston. Movement of this member relative to the cylinder changes the flow path for the fluid and either increases or decreases the resistance to flow of the fluid into and from the cylinder.

In the example illustrated, the tipping means 166 comprises two cylinders with a respective piston acting in each cylinder. Respective end portions of the cylinders are defined by a common head 406 in which there is a passage 446 forming a part of an oil port 414 which has a first predetermined diameter.

The member which is engaged by and is moved by the piston is a movable insert designated by the reference numeral 416. This insert has at least first and second openings, 418, 420 which are of respective different sizes. The spring 422 is provided for biasing the insert 416 into the cylinder 264 so as to be contacted by the piston 410 as the piston is and end 424 of the cylinder 264.

Figure 25 shows the movable insert 416 in a first position in which it protrudes into the cylinder. Figure 26 shows the movable insert in a second position in which it no longer protrudes into the cylinder. By movement of the insert from the first position to the second position, the openings 418 are displaced from alignment with oil port 414 so as to permit alignment of the second opening 420 with that port. In the example illustrated, the bore of the opening 420 is relatively smaller than that of the openings 418 so that fluid flow is restricted when directed through the second opening 420.

The movable insert 416 has at the end of the insert which protrudes into the cylinder when the insert is in the first position, an opening 428 leading to a central passageway 426. When the piston is spaced from the insert, fluid can flow through the opening 428 but contact of the piston with the insert substantially closes the opening 428. One or more additional openings 430 is formed in the movable insert 416 near to the open and 428 to permit continued flow of fluid into or from the central passageway 426 when the opening 428 is closed by the piston and the insert remains in or near to the first position. As the insert is moved by the piston into its second position, the openings 430 become obscured so that fluid can no longer

flow through them. As the piston drives the movable insert from the cylinder, the flow of fluid between the cylinder and the central passage 426 of the insert is progressively restricted until it is terminated.

The piston drives the movable insert 416 from the cylinder as the bin carrier 100 approaches the limit of its upward movement relative to the support 154. Accordingly, the bin carrier is decelerated as it approaches the limit of its upward tipping movement. Furthermore, flow of hydraulic fluid is restricted when return movement of the bin carrier commences so that the bin carrier accelerates gradually. This reduces the magnitude of the forces transmitted between the bin carrier and the bin and reduces the risk of the bin being damaged.

It will be noted that, when in the first position, the movable insert 416 protrudes into the cylinder only a short distance, as compared with the stroke of the piston 410 so that the insert moves with the piston through only a small fraction of the stroke of the piston.

The movable insert 416 is mounted in a fixed, tubular insert 450 which is received in a central passageway 44 defined by the cylinder head 406. The passage 444 is coaxial with the cylinder 264.

The fixed insert 450 has an annular relief 462 which permits fluid to flow around the outside of the fixed insert and through any one of a number of holes 464 formed in the wall of the insert and leading to a central passage thereof. This central passage contains the movable insert 416 which is a sliding fit inside the fixed insert. The movable insert has a flange at one of its ends which engages with the fixed insert to limit travel of the movable insert in a direction towards the piston.

The movable insert 416 also has an annular relief 466 around the outside of the movable insert and adjacent to the second fluid flow path holes 420. Fluid can flow around the outside of the movable insert 416 whenever this insert is in the second position, represented in Figure 26, so that fluid passes through the bore 414, the holes 464, the relief 466 and through the bore 420. The diameter of the bore 420 is typically 0.75mm. In contrast, the holes 418 may have a diameter of up to 4mm. Preferably, there is a plurality of holes 418, there is a plurality of holes 418, for example four. The number of holes 420 is smaller. There may be one or two of these holes.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, or a class or group of substances or compositions, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A bin hoist comprising a bin carrier (100), holding means (102, 104) on the bin carrier for holding a bin (50) on the carrier, a support (154) for the bin carrier and tipping means (166) for tipping the bin carrier relative to the support, wherein the tipping means includes an hydraulic motor and means (416) for restricting the flow of hydraulic fluid to or from the motor as the bin carrier approaches an end of its travel in a tipped attitude.

2. A bin hoist according to Claim 1 wherein the motor includes an hydraulic piston and cylinder unit and wherein the means for restricting flow includes a member (416) which is engaged by and is moved by the piston (410) of said unit as the piston approaches an end of its travel.

3. A bin hoist according to Claim 1 wherein the motor includes an hydraulic piston and cylinder unit and wherein the means for restricting flow includes a member (416) guided for reciprocation relative to a cylinder of said unit along a path parallel to the path of reciprocation of a piston (410) of said unit and wherein said member is engageable by the piston and movable by the piston through only a part of the stroke of the piston as the piston approaches an end of its travel.

4. A bin hoist according to Claim 2 wherein said member (416) has a passage for the flow of hydraulic fluid.

5. A bin hoist according to Claim 1 wherein the hydraulic motor comprises a piston and cylinder unit, an output shaft (186) which is rotatable relative to the cylinder of said unit, a rack and a pinion, the rack (262) being incorporated in or carried on a piston rod of said unit, the pinion being carried on or incorporated in the output shaft (186) and the rack and pinion having respective teeth (260) which are enmeshed with each other within the cylinder of said unit, wherein there is in one end of the cylinder of said unit a passage containing a fixed, hollow insert (450), a slidable insert (416) lies inside the fixed insert, the slidable insert defines alternative flow paths for hydraulic fluid into or from the cylinder, said flow paths having respective different resistances to flow of hydraulic fluid, a spring (422) is provided for biasing the slidable insert towards the interior

of the cylinder and wherein the piston is engageable with the slidable insert to displace the slidable insert relative to the fixed insert and thereby change the path of hydraulic fluid into or from the cylinder as the piston approaches one end of its stroke.

6. A bin hoist according to Claim 5 wherein there is at the outside of the fixed insert (450) an annular passage (462), a plurality of holes (464) is formed through the fixed insert from the passage at the outside thereof to the passage containing the slidable insert (416), the slidable insert includes a plurality of holes defining a first flow path thereof, the slidable insert includes at least one hole (418) defining a second flow path thereof and wherein there is at the outside of the slidable insert and adjacent to the second flow path hole an annular passage (466).

7. A bin hoist according to Claim 5 wherein the slidable insert (416) includes a central passage and a lateral hole (418) communicating between the outside of the slidable insert and the central passage thereof.

8. A bin hoist according to Claim 3 wherein said member (416) has means for limiting travel of the member relative to the cylinder in a direction towards the piston.

9. A hoist comprising a bin carrier (100), holding means (102, 104) on the bin carrier for holding a bin on the carrier, a support (154) for the bin carrier, at least one pair of arms (192, 216), each arm being connected between the support and the bin carrier and arranged for pivoting relative to both the support and the bin carrier about respective mutually parallel axes and tipping means for tipping the bin carrier relative to the support between a lowered position and a raised position, wherein, when the bin carrier is in the lowered position, the axis about which one of said arms pivots relative to the bin carrier is offset from a plane containing at least two other of said axes in a direction from the support towards the holding means.

10. A hoist according to Claim 7 wherein one arm (216) of the or each pair of arms is substantially shorter than is the other arm (192) of the pair.

11. A bin hoist comprising a bin carrier (100), holding means (102, 104) on the bin carrier for holding a bin on the carrier, a support (154) for the bin carrier and tipping means (166) for tipping the bin carrier relative to the support, wherein the bin carrier includes a bin rest (226) arranged for movement relative to the bin carrier between an extended position and a retracted position, the movement of the bin rest relative to the bin carrier from the extended position to the retracted position being upward movement when the bin carrier is in a lowered position.

12. A bin hoist according to Claim 11 further comprising means for extending the bin rest (226) when the bin carrier is tipped relative to the support.

13. A bin hoist according to Claim 12 wherein said means for extending includes a link connected with the bin rest and connected with the support.

14. A method of lifting and tipping a bin to discharge contents from the bin wherein the bin is raised from the ground, is tipped at an approximately uniform rate until a top of the bin is lower than a bottom of the bin and wherein the rate of tipping is then reduced before the bin reaches the limit of its travel.

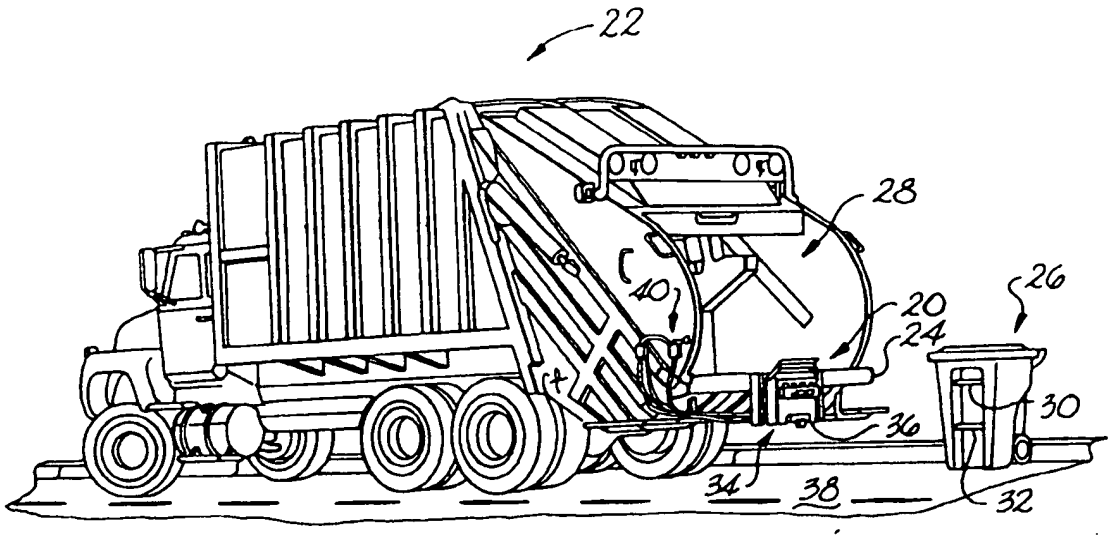

Fig. 1

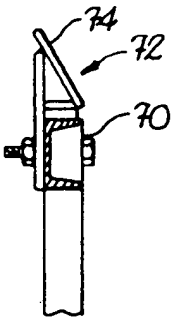

Fig. 2B

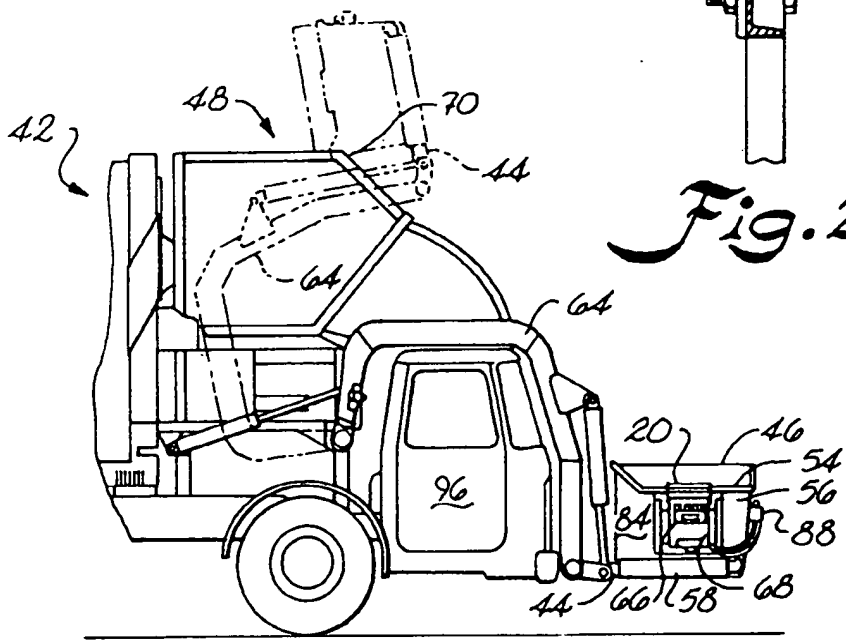

Fig. 2A

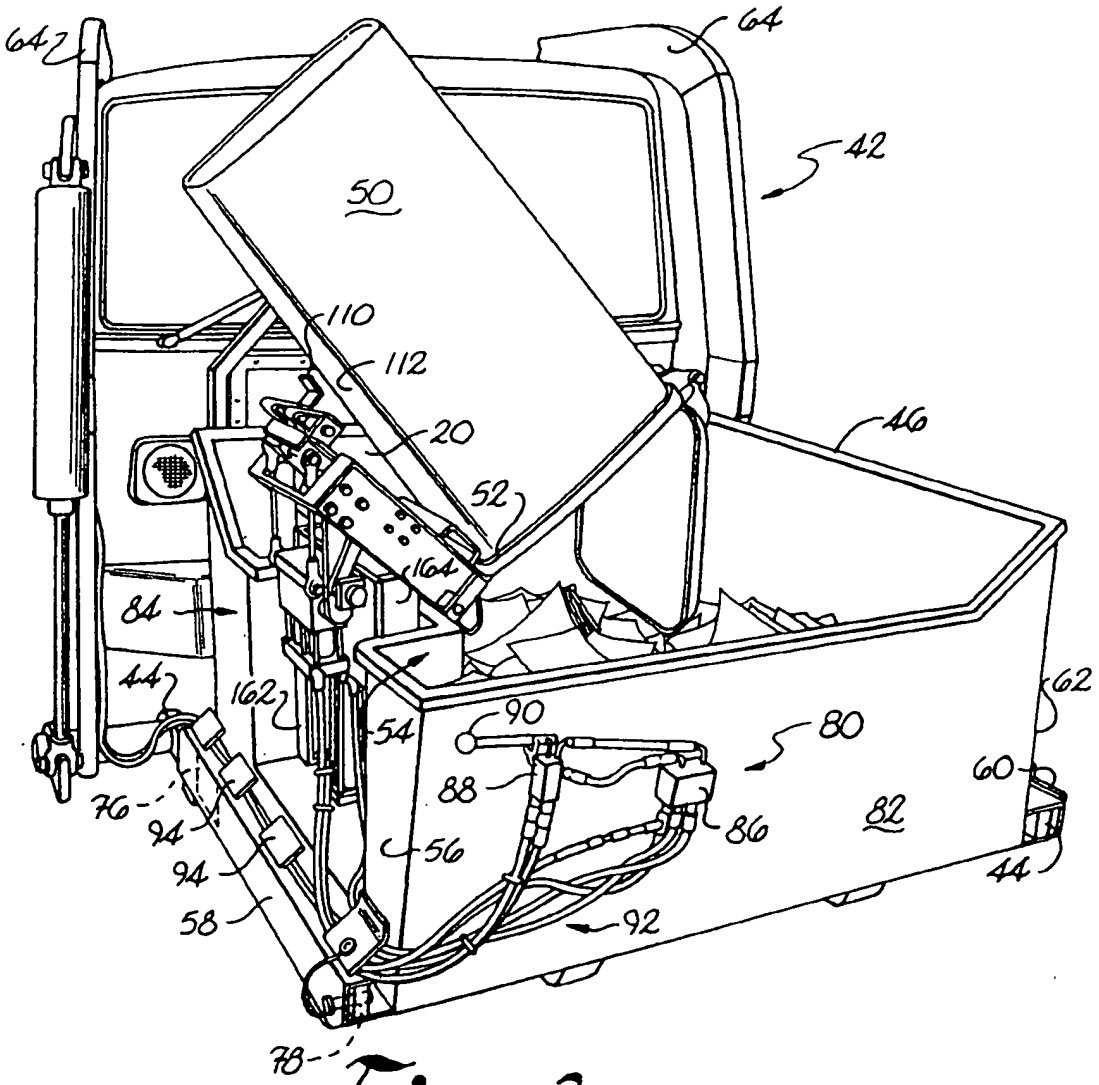
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Fig. 3

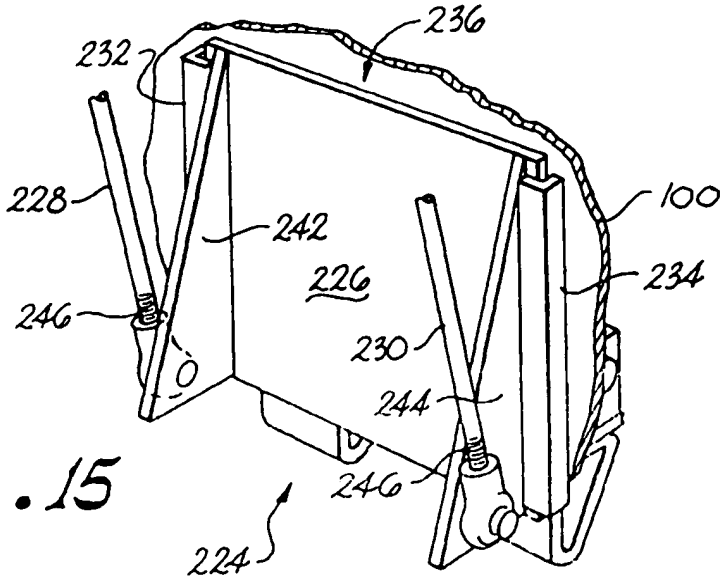
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Fig. 15

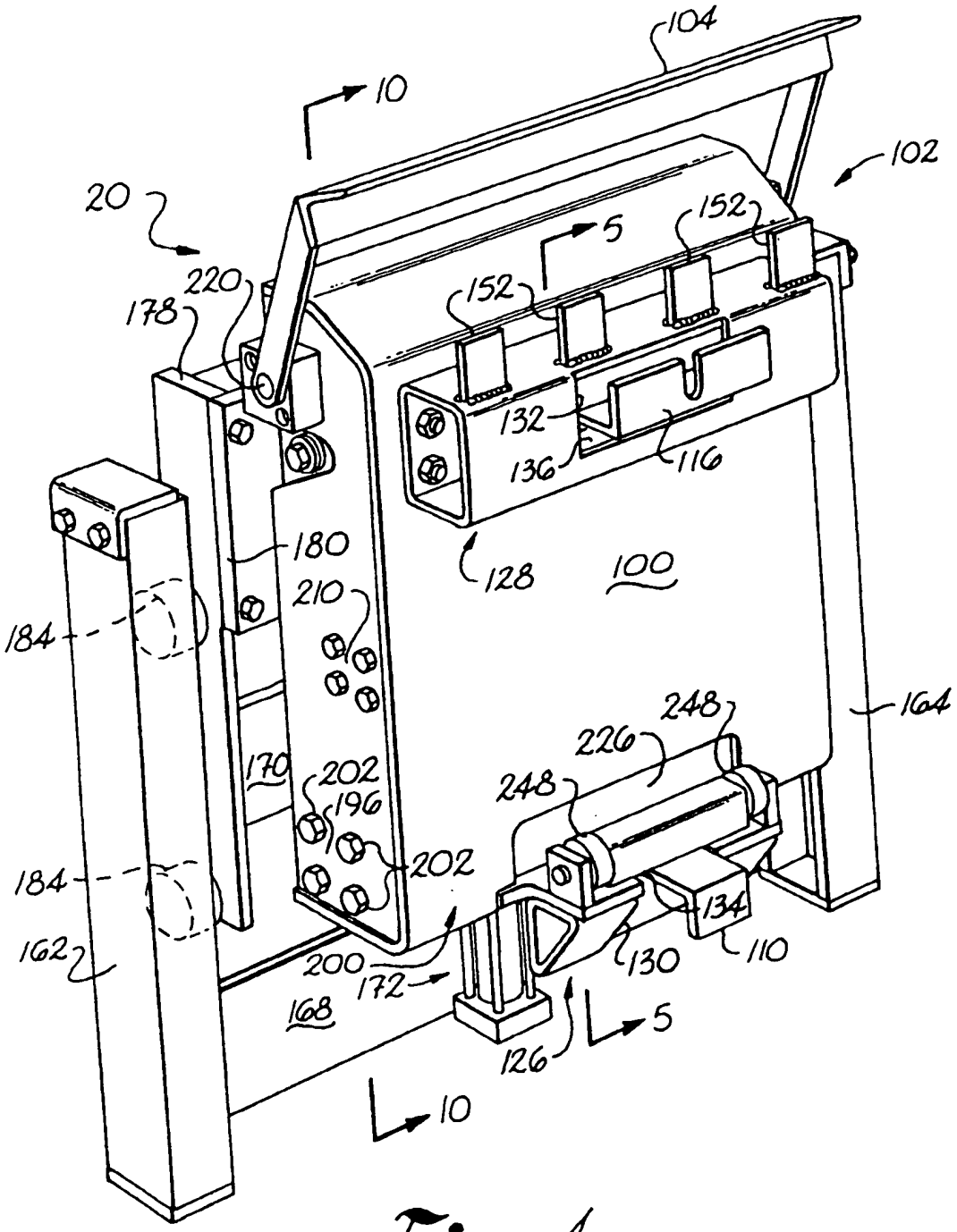
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Fig. 4

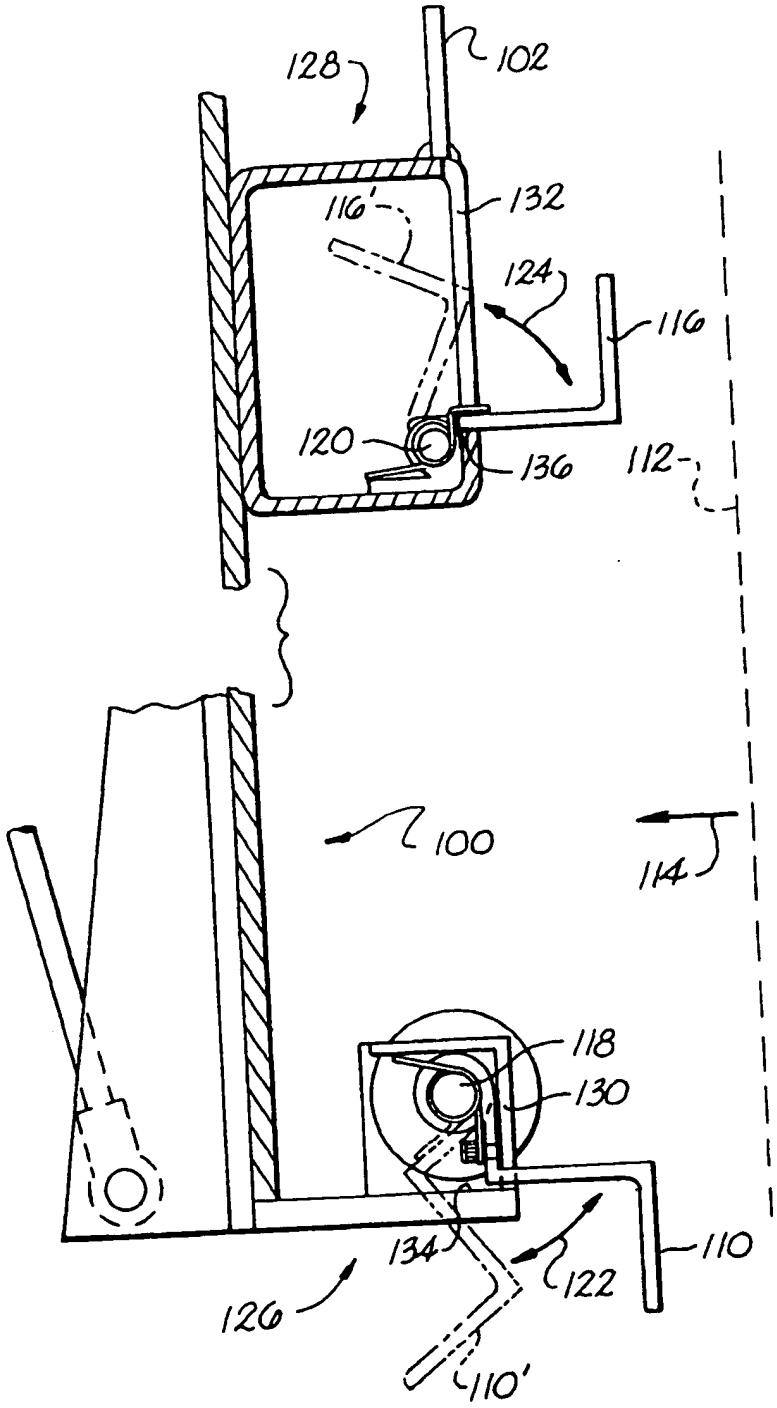
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Fig. 5

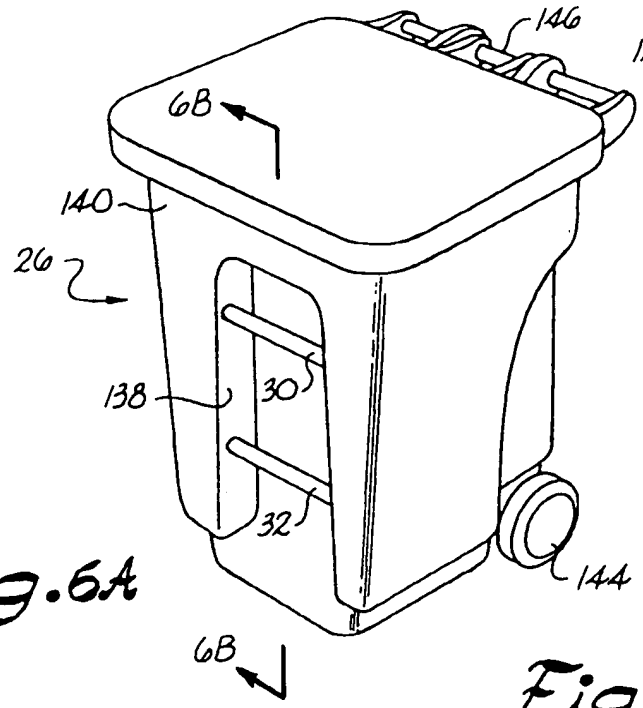

Fig. 6A

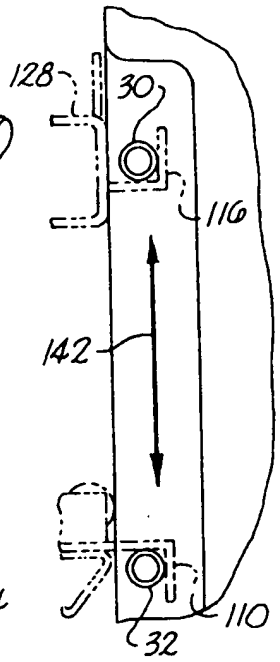

Fig. 6B

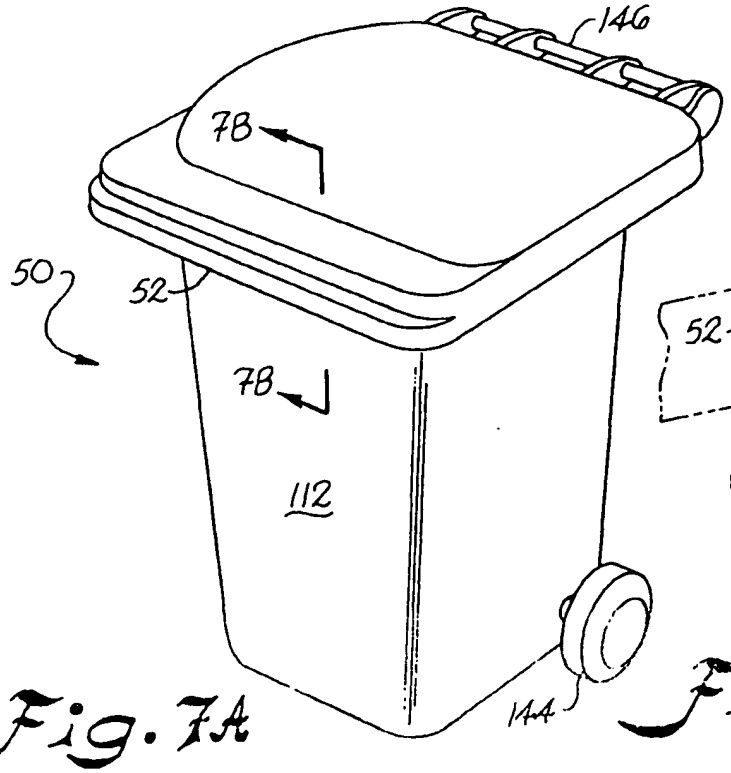

Fig. 7A

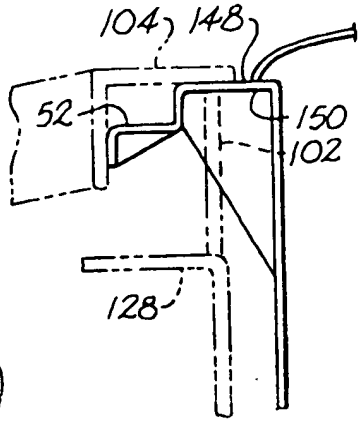

Fig. 7B

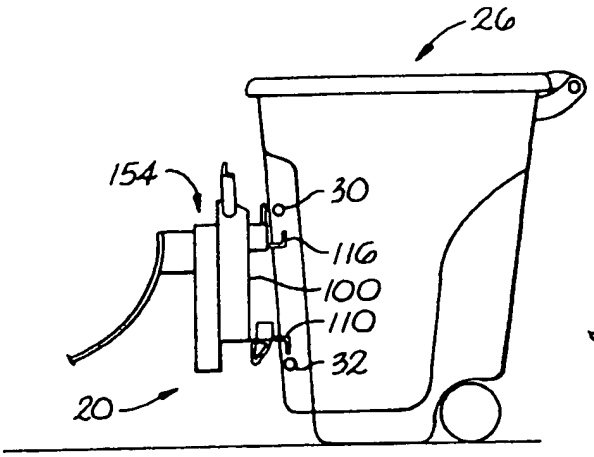

Fig. 8A

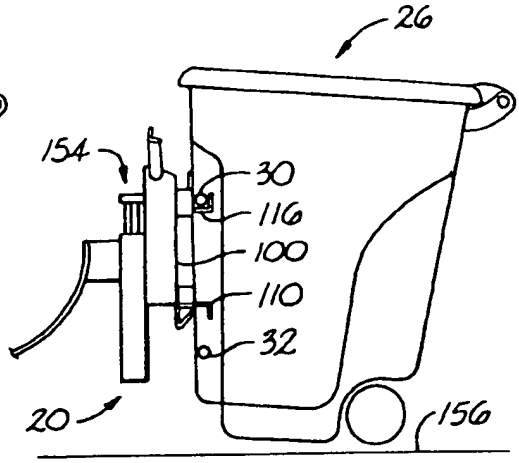

Fig. 8B

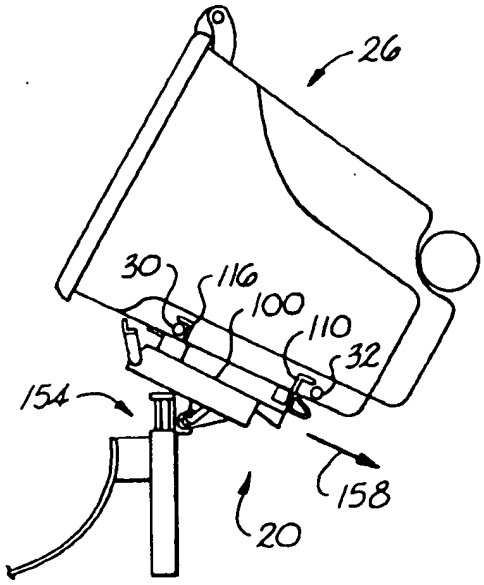

Fig. 8C

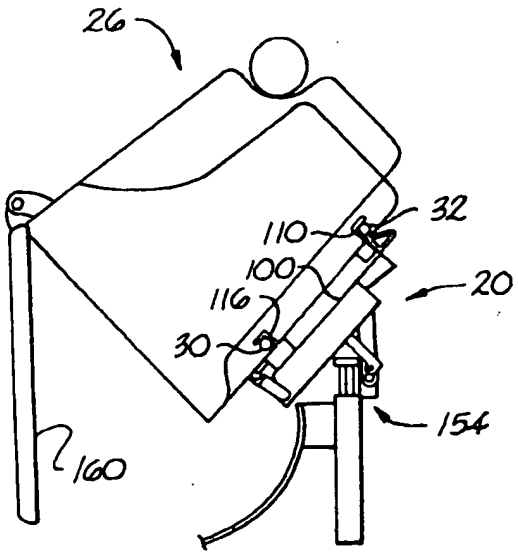

Fig. 8D

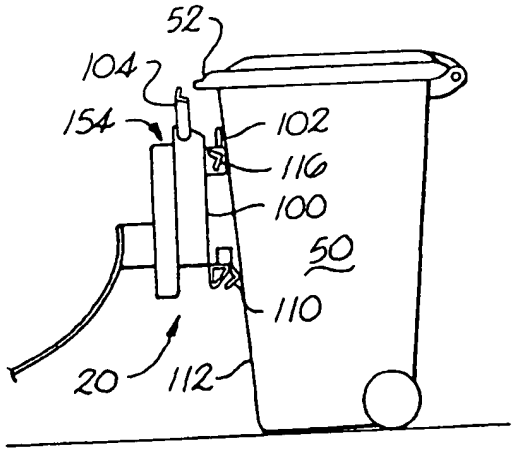

Fig. 9A

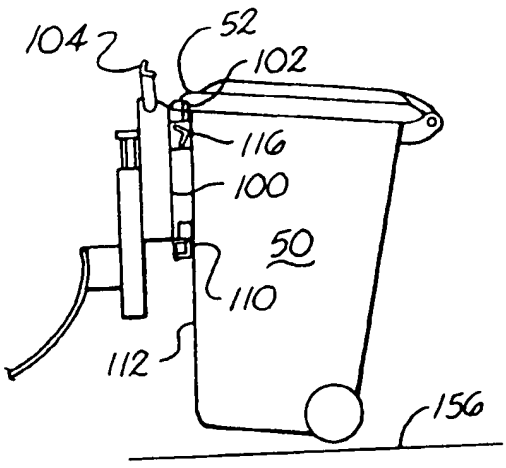

Fig. 9B

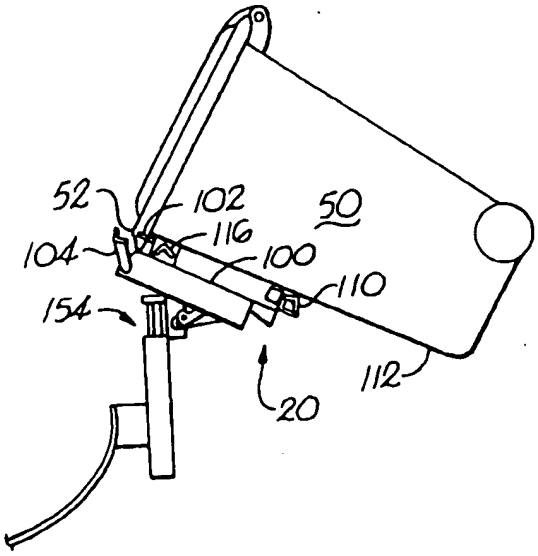

Fig. 9C

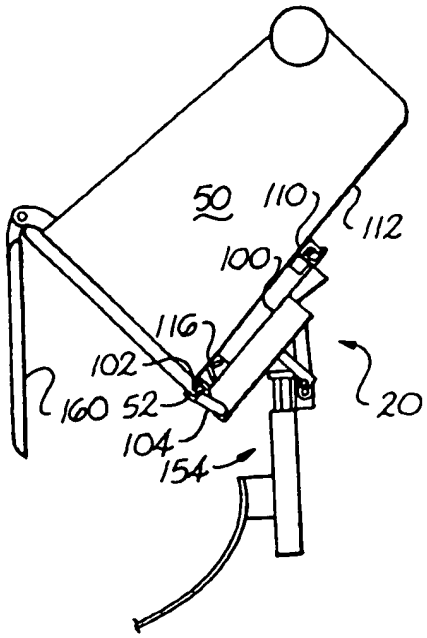

Fig. 9D

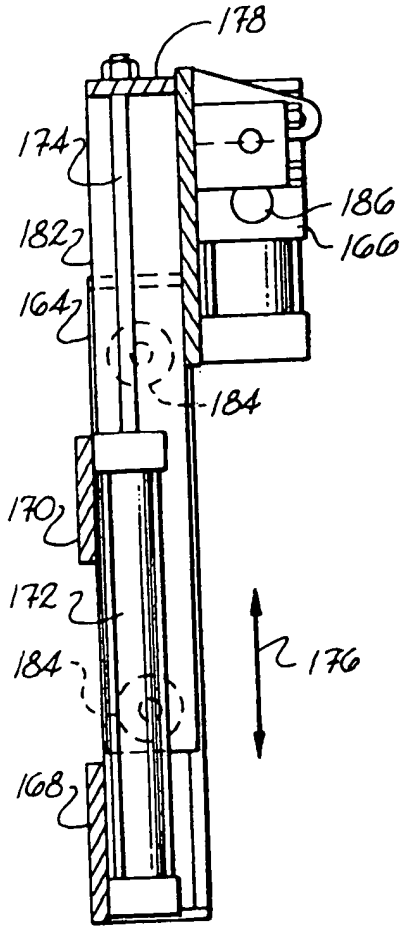
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Fig. 14

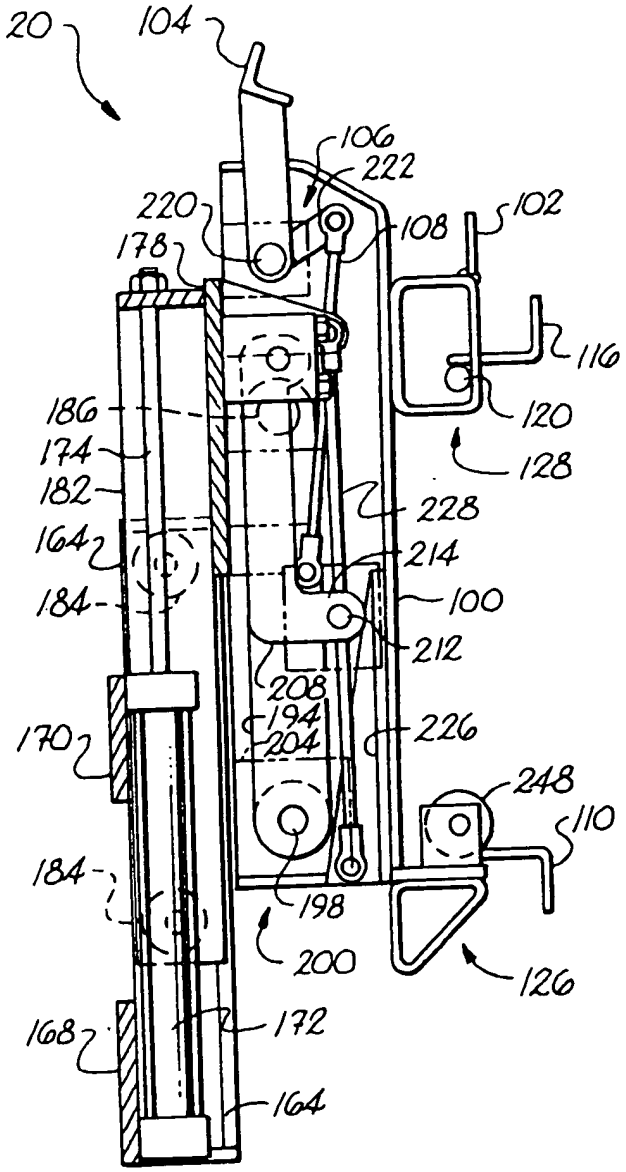
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Fig. 10

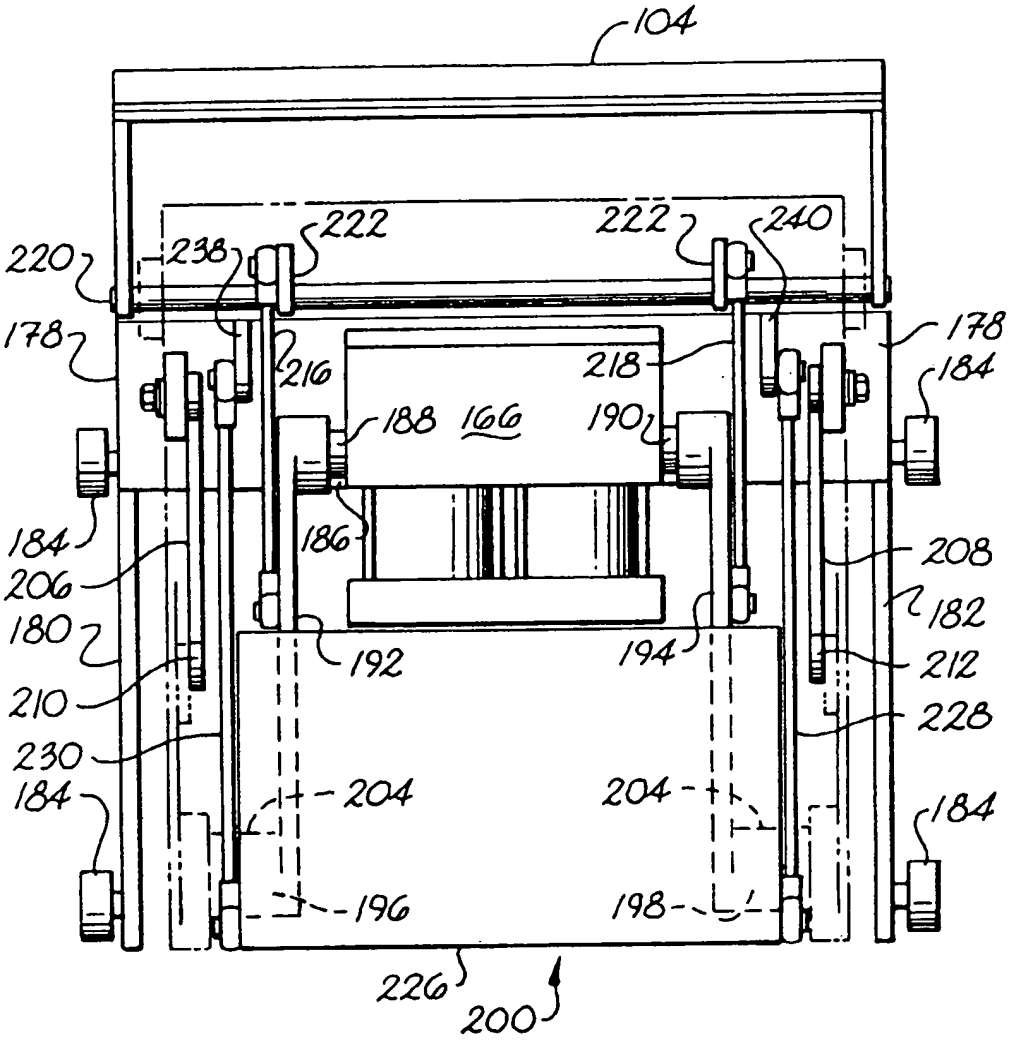
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Fig. 11

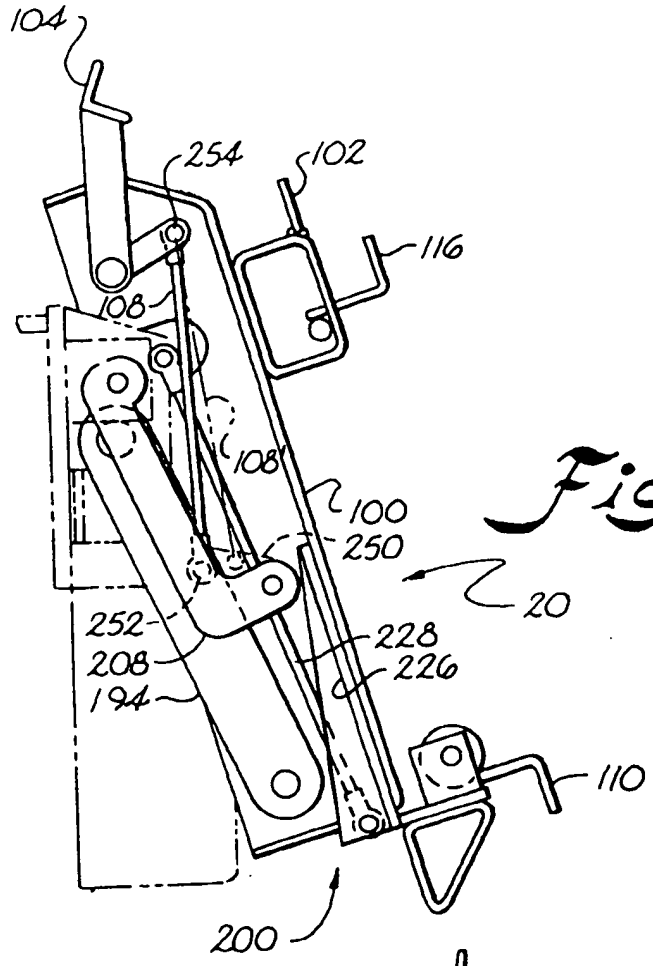


Fig. 12A

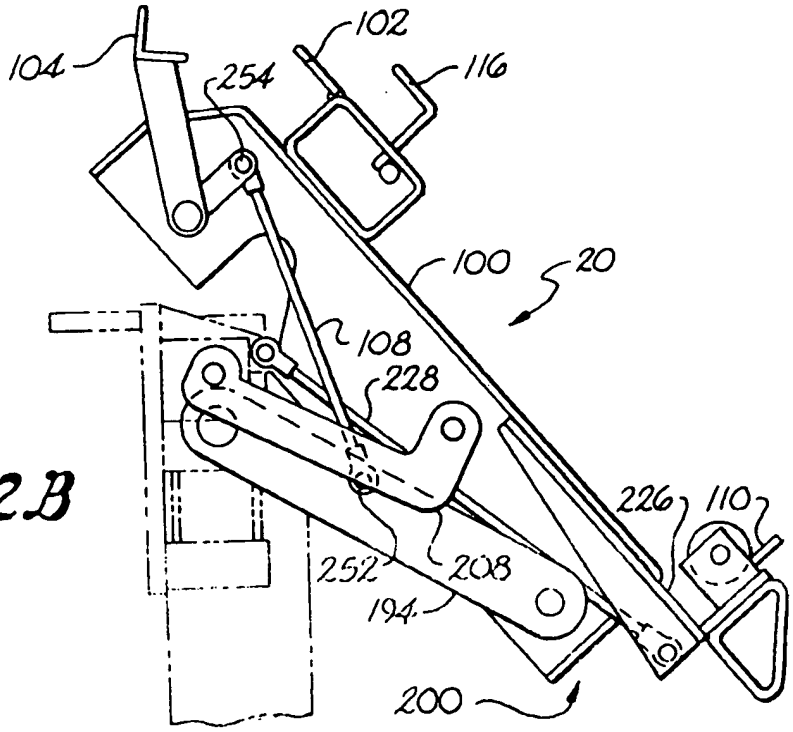


Fig. 12B

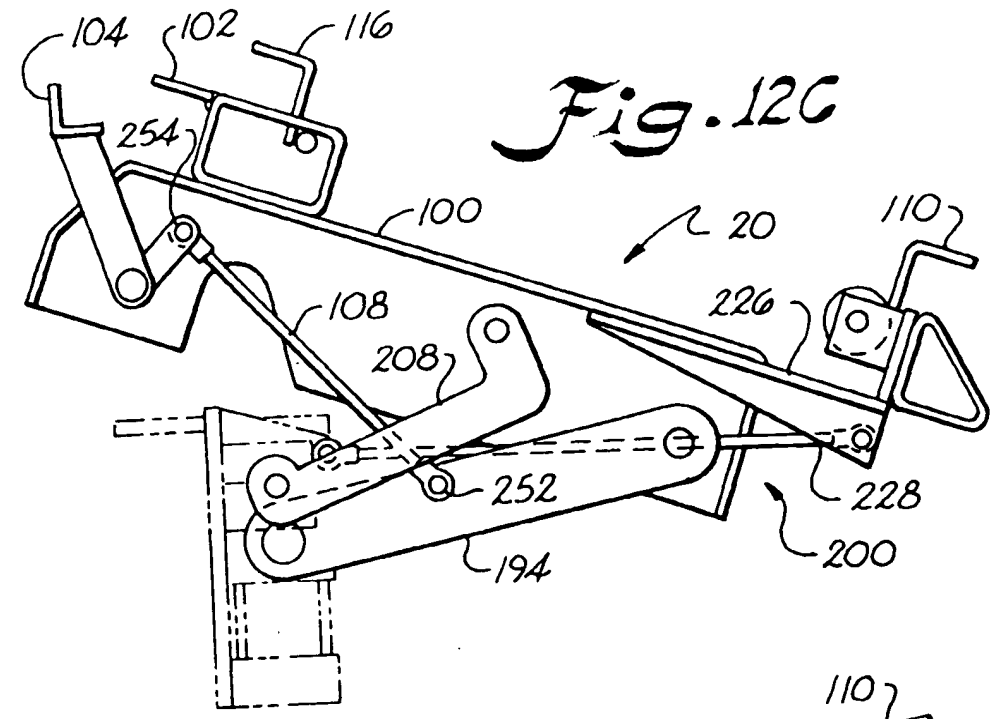


Fig. 12C

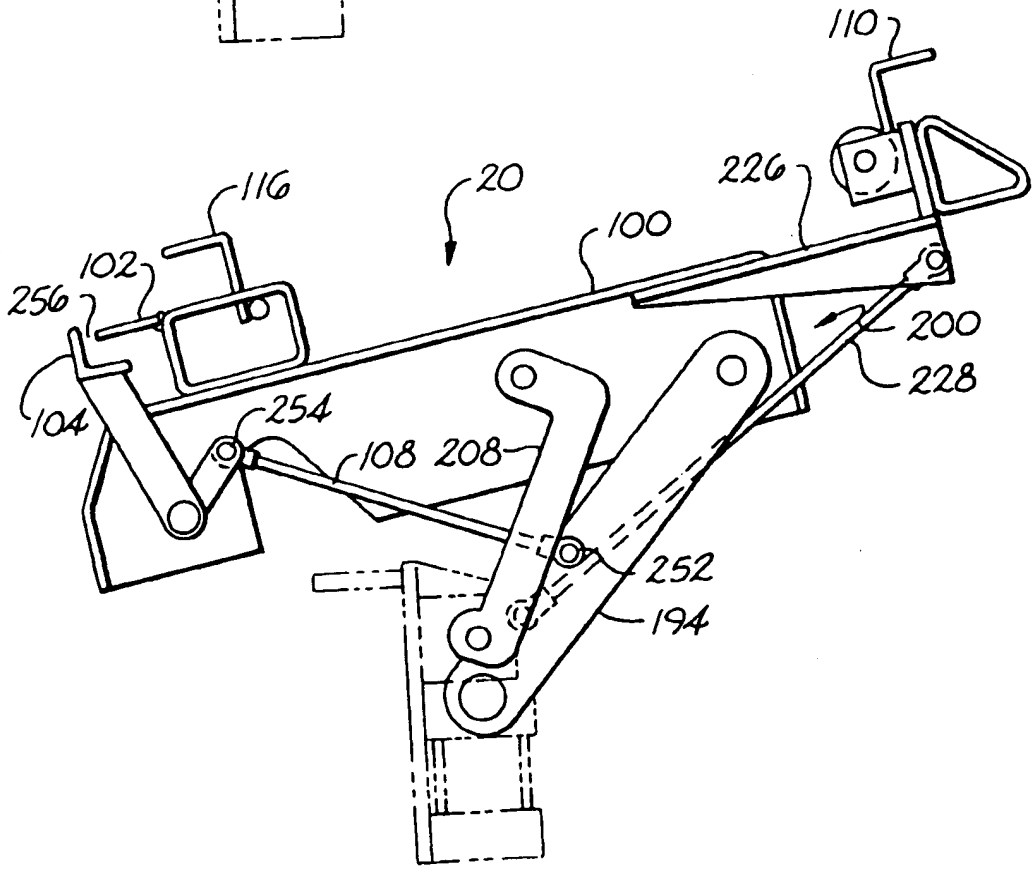


Fig. 12D

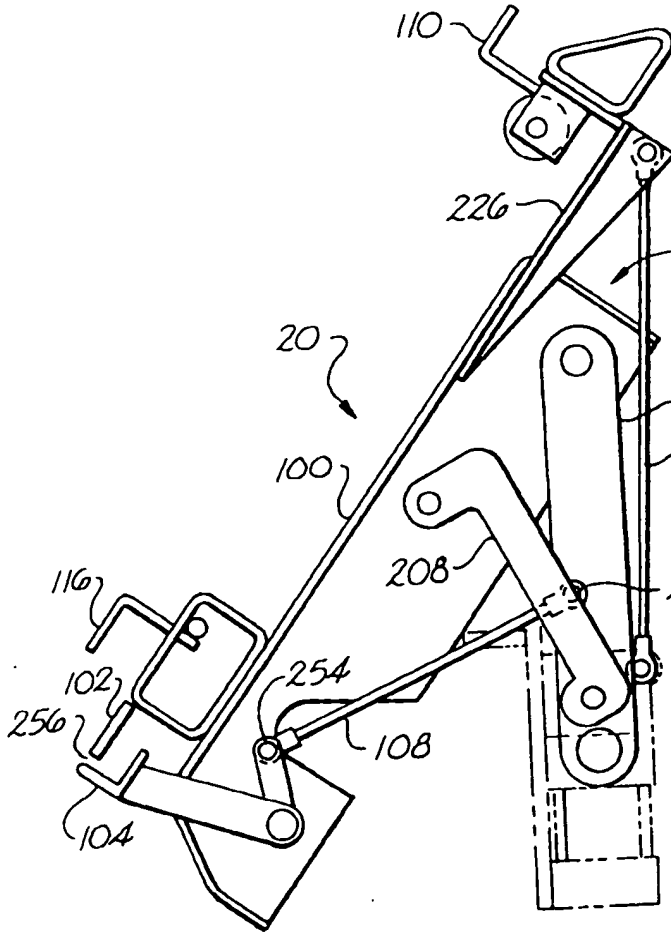


Fig. 12E

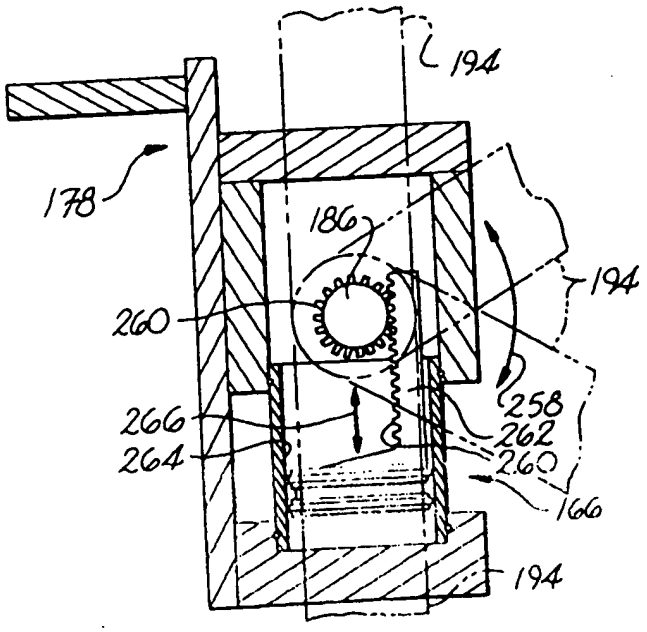
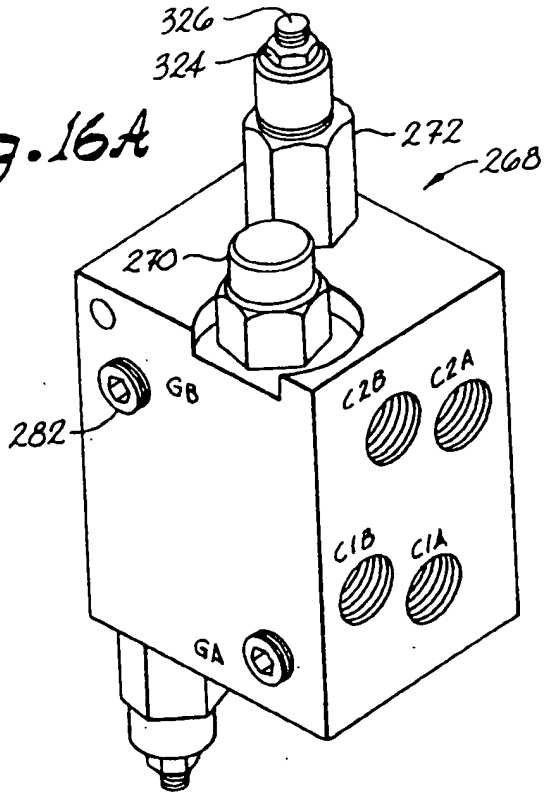


Fig. 13

Fig. 16A



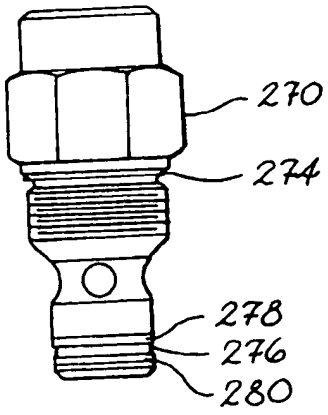
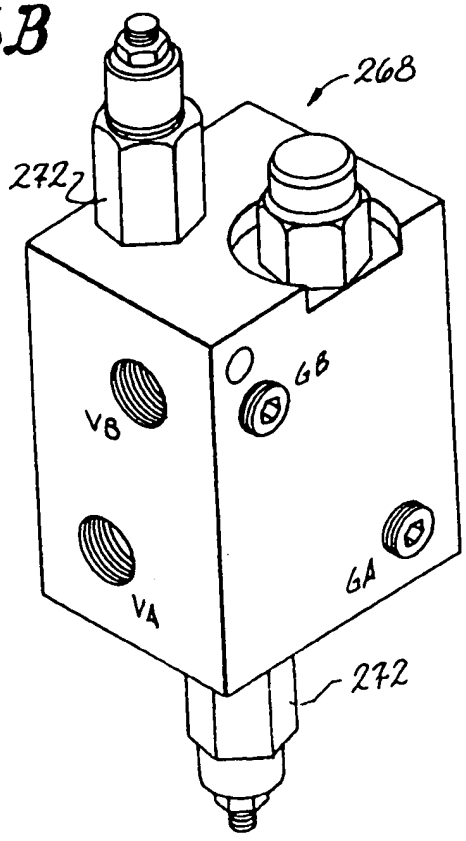


Fig. 17

Fig. 16B



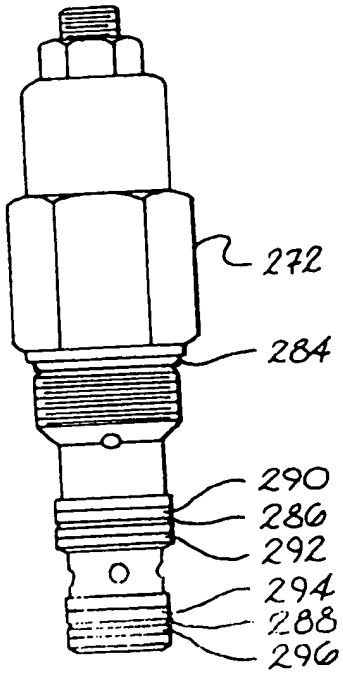
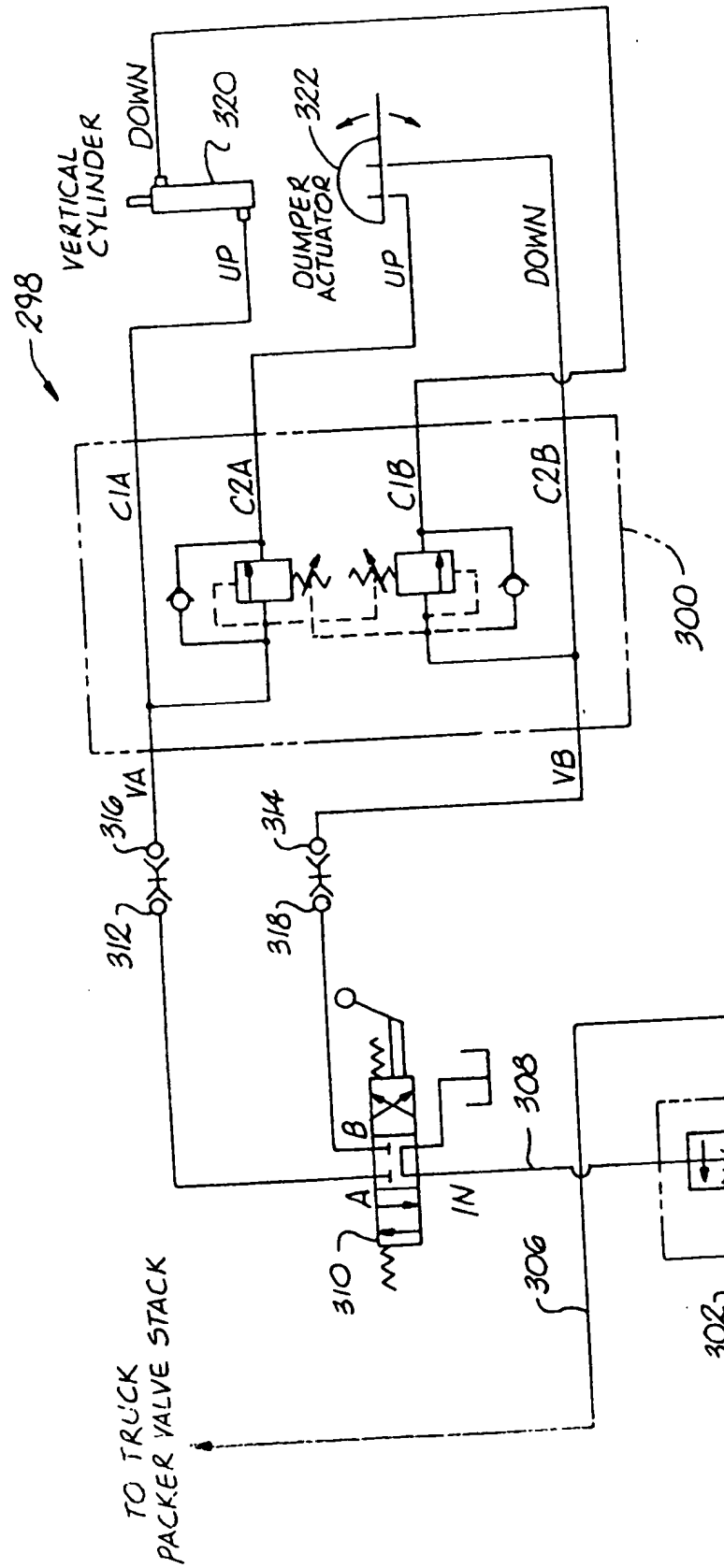


Fig. 18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VERTICAL CYLINDER
DOWN
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UP
DUMPER ACTUATOR
322
UP
DOWN
C1A
C2A
C1B
C2B
300
316
VA
314
VB
312
318
B
A
310
IN
308
306
302
304
TO TRUCK PACKER VALVE STACK
MAIN PRESSURE LINE FROM PUMP

Fig. 19

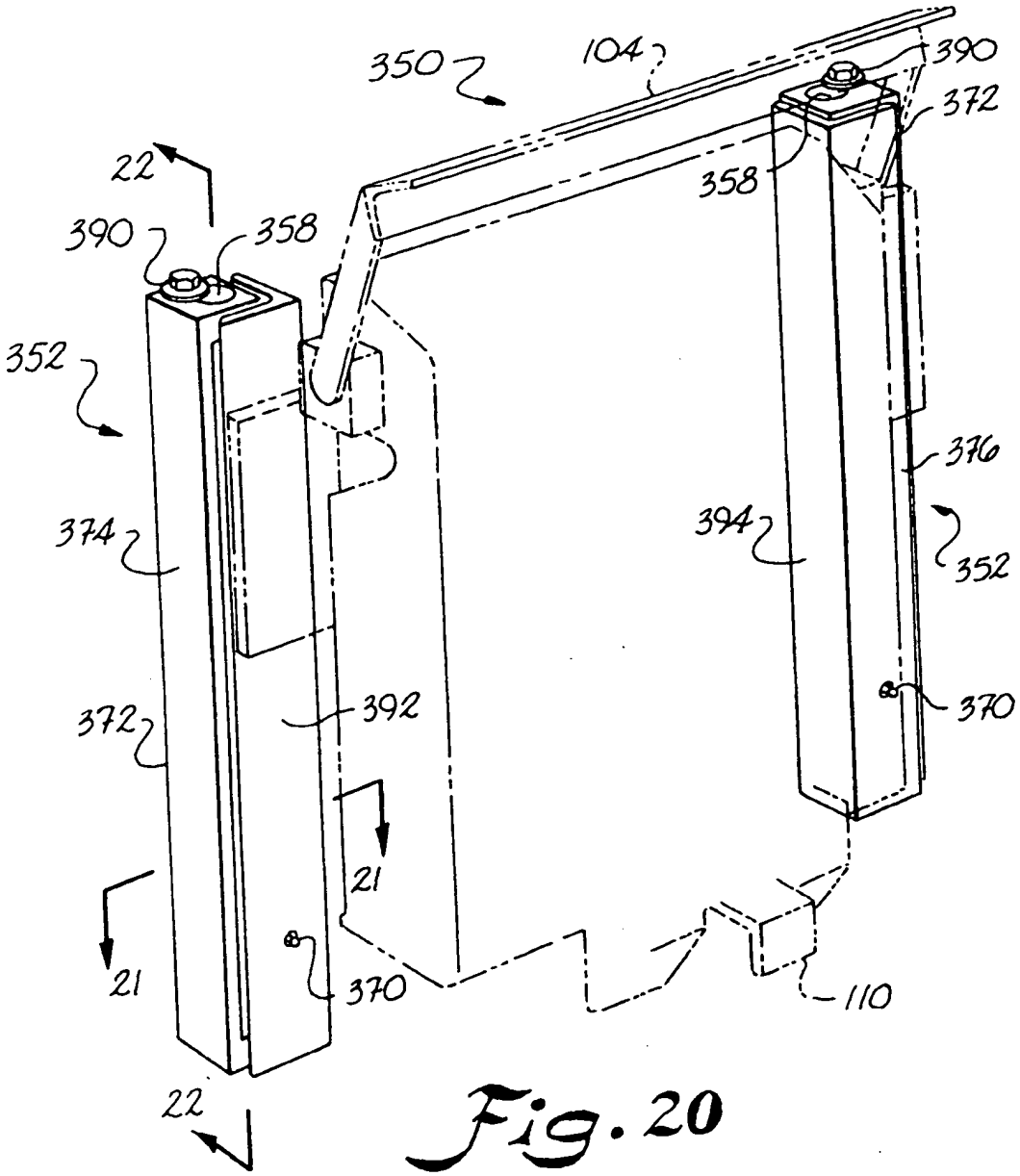
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Fig. 20

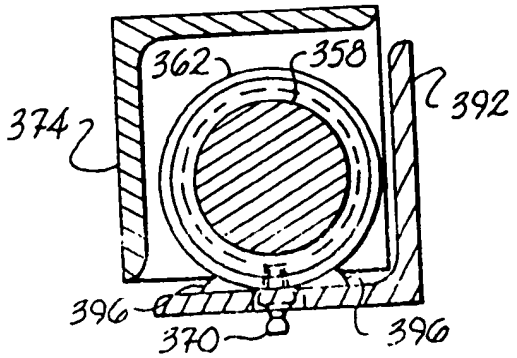
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Fig. 21

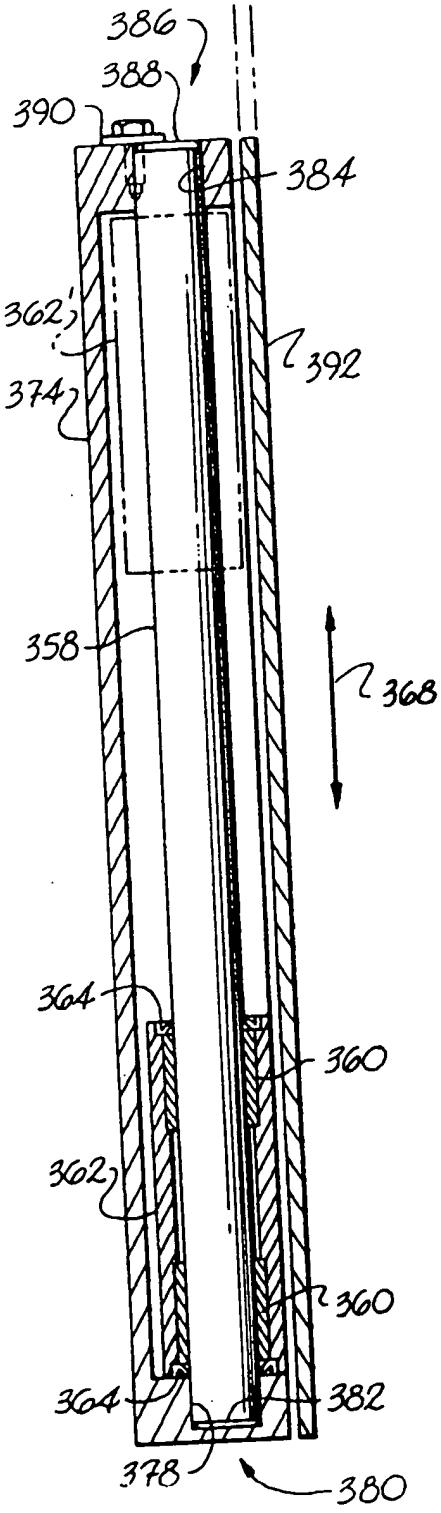
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Fig.22

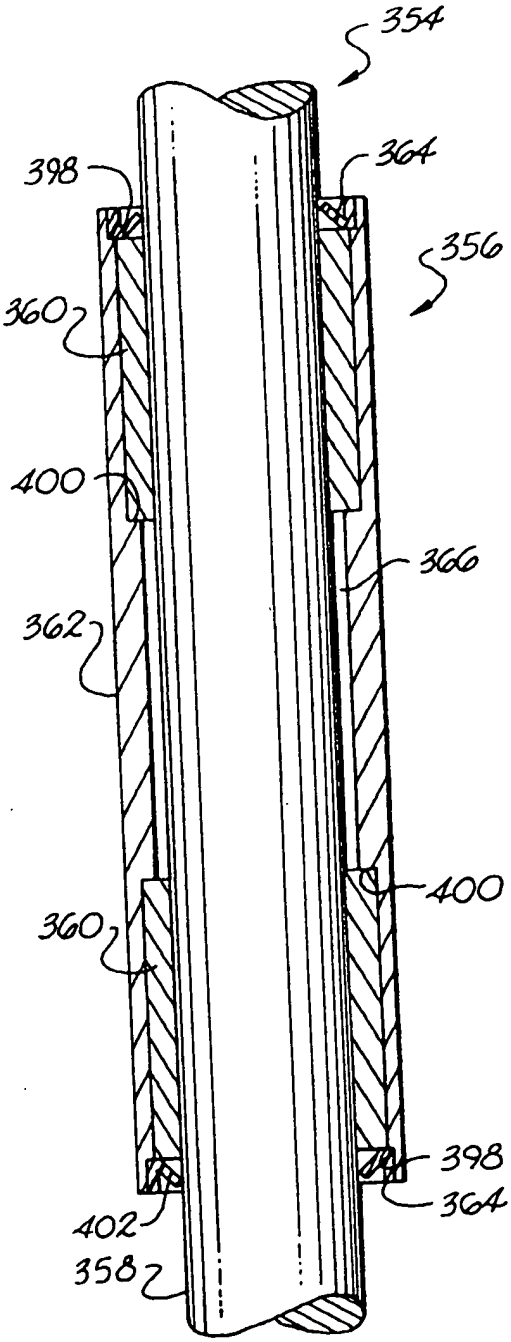
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Fig.23

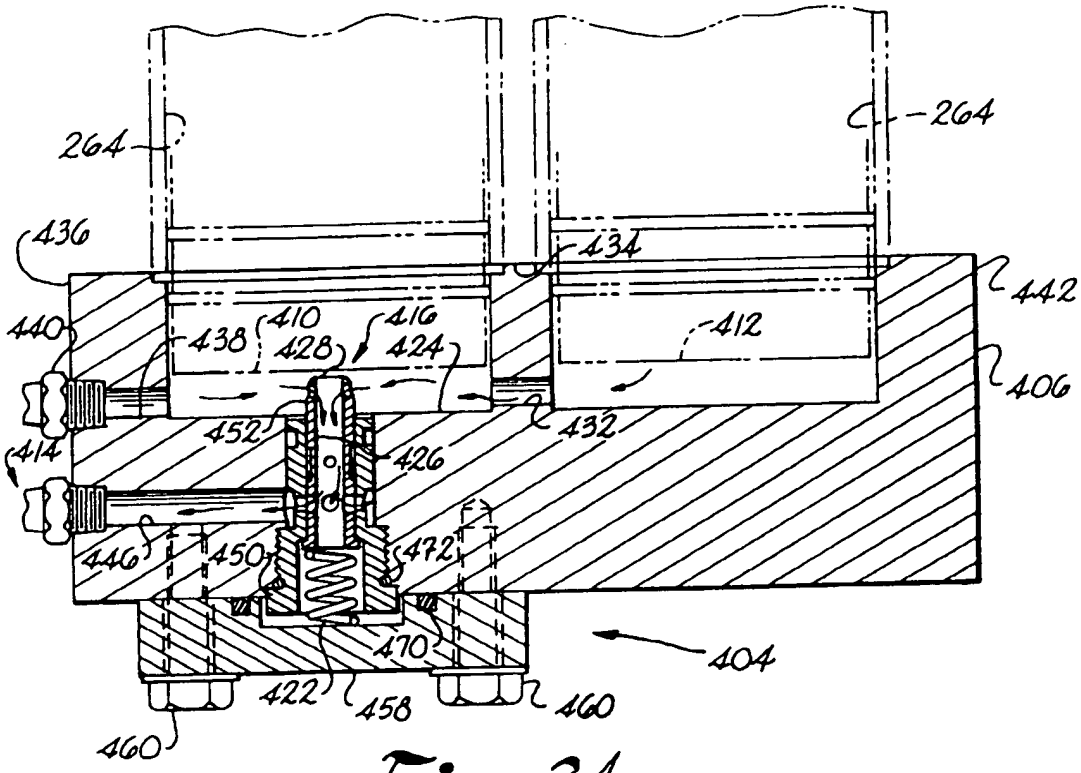

Fig. 24

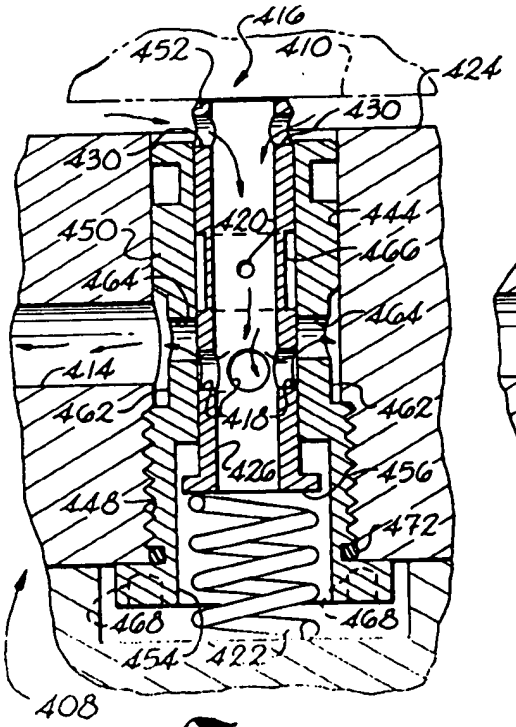

Fig. 25

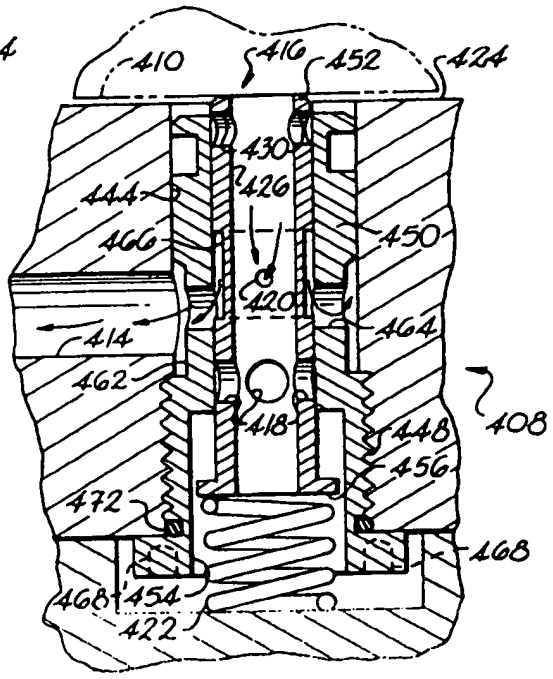

Fig. 26